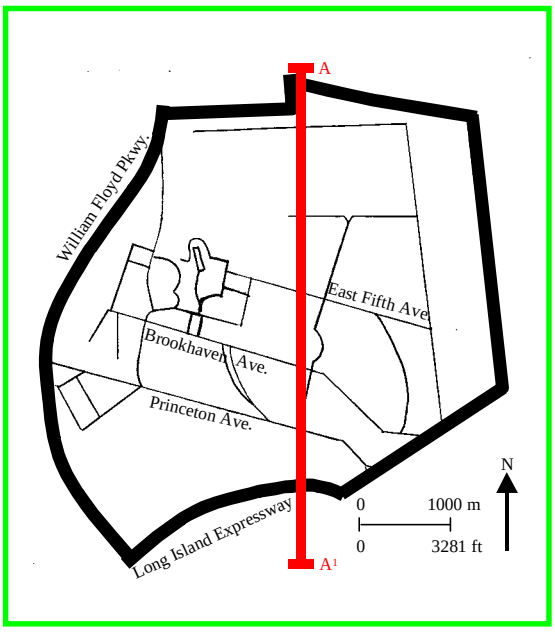
Vadose Zone Fact Sheet
Brookhaven National Laboratory

Background: Brookhaven National Laboratory (BNL) is a 22 km^2 (5,321 acre) federal facility located 100 km (60 mi) east of New York City. BNL has been involved in research and development activities in both basic and applied research in high energy and nuclear physics for Department of Energy and its predecessor agencies since 1947.

Issues: Vadose zone contamination and remediation (excluding soils) are not high priority concerns at BNL. Considering the thin vadose zone, high annual precipitation, and high infiltration rate, mobile contaminants (i.e., volatile organic compounds, strontium-90, and tritium) tend to be flushed through the vadose zone to the ground water in a relatively short period of time. Persistent, non-volatile, and very slow to non-degradable contaminants (i.e., metals, cesium-137), polychlorinated biphenyl (PCB), and many pesticides sorb strongly to soils, are relatively immobile, and are being remediated as soil removal actions. There is some concern with vadose zone contamination at the Brookhaven Graphite Research Reactor (strontium-90), which is being further investigated.



Vadose zone infiltration: Infiltration through the vadose zone is high. The direct precipitation recharge to the ground water is estimated to be approximately 58 cm (23 in) per year.

Vadose zone characterization/remediation: Characterization and remediation of contaminated soils is ongoing. An interim soil cleanup in Operable Unit (OU) IV was completed in 1994. Contaminated soils were removed as part of a tank removal action in OU III in 1999.

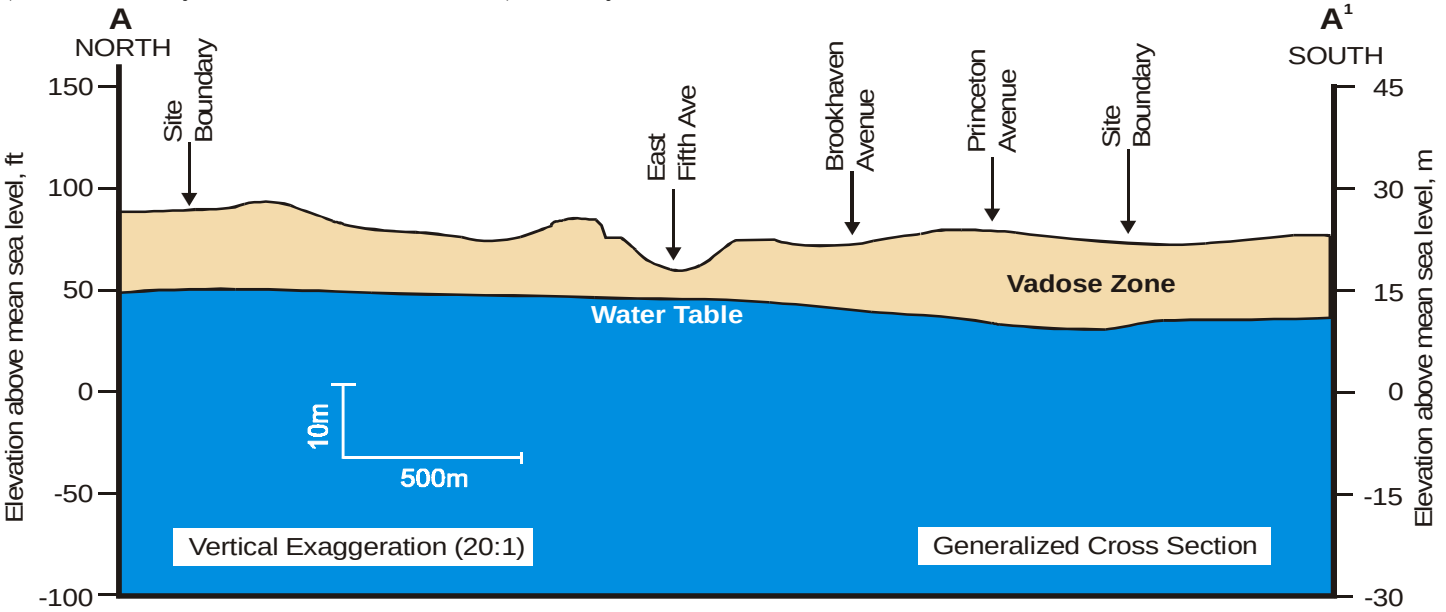
Precipitation: Average annual precipitation is approximately 122 cm (48 in).

Surface Water: Several small creeks form the Peconic River headwaters in the northeast quadrant of the site, flowing off-site along the eastern site boundary. The Carmans and Forge Rivers are in the near proximity of the site. There are also numerous ponds, both natural and manmade, and several recharge basins.

Geology: BNL is situated between glacial moraines on a relatively flat outwash plain, with surface elevations ranging from 14 to 30 m (45 to 100 ft) above mean sea level. The subsurface consists of over 488 m (1600 ft) of unconsolidated sediments overlying crystalline bedrock.

Vadose zone thickness: Generally 3 to 12 m (10 to 40 ft).

Major contaminants of concern: Mercury, cesium-137, strontium-90, tritium, PCB, benzo(a)pyrene, volatile organic compounds (i.e., trichloroethylene and carbon tetrachloride), and ethylene dibromide.



September 2000

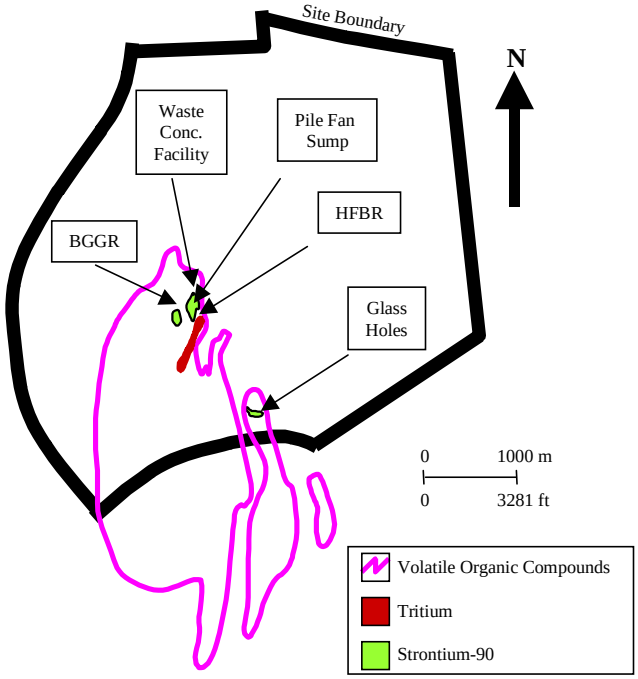
Ground Water Fact Sheet
Brookhaven National Laboratory

Background: Brookhaven National Laboratory (BNL) is a 22 km^2 (5,321 acre) federal facility located 100 km (60 mi) east of New York City. BNL has been involved in research and development activities in both basic and applied research in high energy and nuclear physics for Department of Energy and its predecessor agencies since 1947.

Hydrogeology: The aquifer underlying BNL is designated as a sole source aquifer. Past waste disposal and handling procedures at BNL have resulted in several ground water plumes containing radioactive and non-radioactive contaminants. The three major types of ground water plumes requiring remediation at BNL are volatile organic compound (VOC), strontium-90, and tritium. Ground water flow is to the south, with ground water velocities ranging from 11 to 91 m (35 to 300 ft) per year.

Issues: The VOC plumes extend beyond the southern boundary of BNL and although the groundwater contaminants are found to be deeper than most residential wells, as a precautionary measure, residents immediately south of BNL were offered public water hookups. There also is high public awareness of the on-site radioactive plumes.

Ground Water Characterization/Remediation: Initial characterization has been completed (Remedial Investigation/Feasibility Study/Proposed Plan). Actions conducted to date for VOC contamination include public water hookups, two on-site treatment systems (operating at the southern boundary since 1996 and 1997), an off-site treatment facility (operation began Sept. 1999), source removals, and monitoring. Strontium-90 actions to date include excavation of the chemical holes, excavation of contaminated soils, and monitoring. Tritium actions to date (for the High Flux Beam Reactor [HFBR] plume) include pump-and-recharge at the leading edge of the plume (operating since 1997), emptying the HFBR spent fuel tank (1977), and monitoring. Proposed remedial alternatives include using monitored natural attenuation in conjunction with other active remedial approaches such as traditional pump and treat systems for hydraulic control and implementation of innovative in-well air stripping technologies.



Ground Water Plumes Greater Than Drinking Water Standards

Ground Water Use: Off-site residents in the vicinity of the plumes have been provided hookups to the county water supply. BNL operates potable supply wells for on-site workers and residents.

Plume Type	Depth	Remedial Approach
VOCs (primarily carbon tetrachloride, tetrachloroethane, and trichloroethane)	14 to 91 m (45 to 300 ft)	Pump and treat; in-well stripping; monitored natural attenuation of lower concentrations
Strontium-90	5 to 30 m (15 to 100 ft)	Pump and treat (ion exchange); monitored natural attenuation of lower concentrations
Tritium	11 to 30 m (35 to 100 ft)	Monitored natural attenuation; low-flow pumping when concentrations exceed specified trigger levels